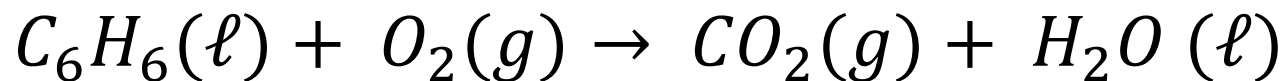
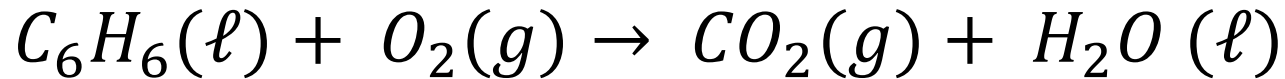


Determine the limiting reagent in the combustion of benzene when 24 grams of benzene is mixed with 62.5 liters of O₂. Please first balance the chemical equation.



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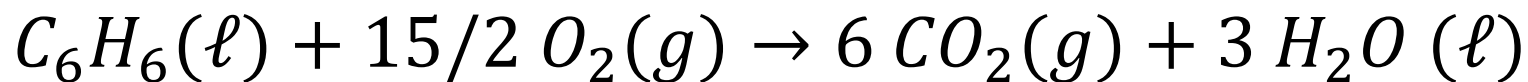
Solution: Step 1. Balance the chemical equation



Step 2. calculate the number of moles of C₆H₆ and O₂ in the reaction

$$n_{C_6H_6} = \frac{m_{C_6H_6}}{M_m} = \frac{24 \text{ gm}}{78 \text{ gm/mol}} = 0.307 \text{ mol}$$

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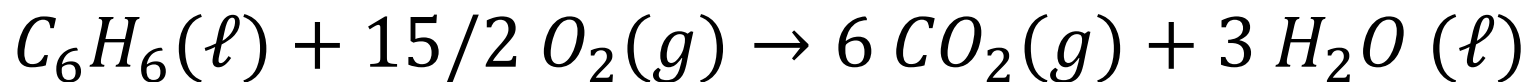
Step 2 (contd.. calculate the number of moles of C₆H₆ and O₂ in the reaction

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$$n_{O_2} = \frac{PV}{RT} = \frac{(1 \text{ atm})(62.5 \text{ L})}{\left(0.08206 \frac{\text{Latm}}{\text{molK}}\right)(298 \text{ K})} = 2.555 \text{ mol}$$

To see which is the limiting reagent we must compare the actual mole ratio to the stoichiometry.

Determine the limiting reagent in the combustion of benzene when 24 grams of benzene is mixed with 62.4 liters of O₂.



The actual mole ratio is

$$\frac{n_{O_2}}{n_{C_6H_6}} = \frac{2.555 \text{ mol}}{0.307 \text{ mol}} = 8.32$$

The stoichiometric ratio is 7.5. Therefore, there is an excess of O₂ and the C₆H₆ is the limiting reagent.